

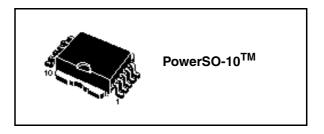
VN330SP-32-E

Quad high side smart Power solid state relay

Features

Туре	V _{demag} (1)	R _{DSon} ⁽¹⁾	I _{out} ⁽¹⁾	v _{cc}
VN330SP-32-E	V _{CC} -55V	$0.32\Omega^{(2)}$	1A	36V

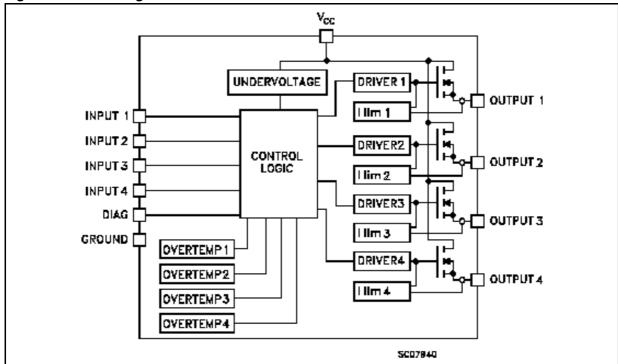
- 1. Per channel.
- 2. At $T_J = 85^{\circ}C$
- Output current : 1A per channel
- Digital input clamped at 32V minimum voltage
- Shorted load and overtemperature protections
- Built-in current limiter
- Undervoltage shut-down
- Open drain diagnostic output
- Fast demagnetization of inductive loads
- Conforms to IEC 61131-2



Description

The VN330SP-32-E is a monolithic device made using STMicroelectronics VIPower technology, intended for driving four indipendent resistive or inductive loads, with one side connected to ground. Active current limitation avoids dropping the system power supply in case of shorted load. Built-in thermal shut-down protects the chip from overtemperature and short circuit. The open drain diagnostic output indicates overtemperature conditions.





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VN330SP-32-E Maximum ratings

1 Maximum ratings

Table 1. Absolute maximum rating

Symbol	Parameter	Value	Unit
V _{CC}	Power supply voltage	45	V
-V _{CC}	Reverse supply voltage	-0.3	V
I _{OUT}	Output current (continuos)	Internally limited	Α
I _R	Reverse output current (per channel)	-6	Α
I _{IN}	Input current (per channel)	± 10	mA
I _{DIAG}	Diag pin current	± 10	mA
V _{ESD}	Electrostatic discharge (R = 1.5KΩ; C = 100pF)	2000	V
E _{AS}	Single pulse avalanche energy per channel not simultaneously Figure 4.	400	mJ
P _{tot}	Power dissipation at T _c = 25°C	Internally limited	w
TJ	Junction operating temperature	Internally limited	°C
T _{STG}	Storage temperature	-55 to 150	°C

Table 2. Thermal data

Symbol	Parameter		Max Value	Unit
R_{thJC}	Thermal resistance junction-case (1)	Max	2	°C/W
R _{thJA}	Thermal resistance junction-ambient (2)	Max	50	°C/W

^{1.} Per channel

^{2.} When mounted using minimum recommended pad size on FR-4 board

Pin connections VN330SP-32-E

2 Pin connections

Figure 2. Connection diagram (top view)

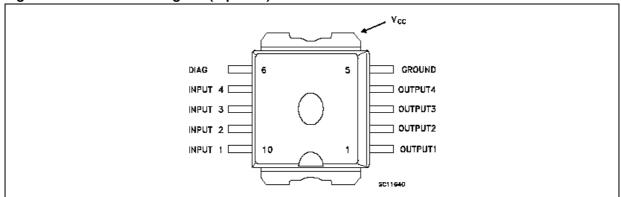
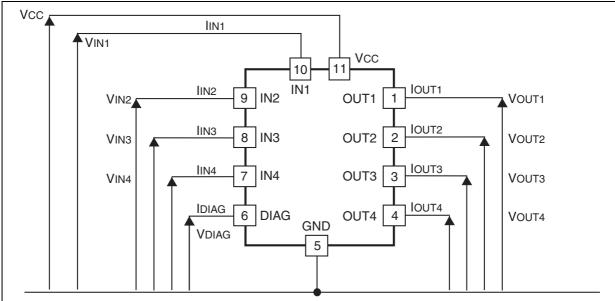


Figure 3. Current and voltage conventions



VN330SP-32-E Electrical characteristics

3 Electrical characteristics

 $10V < V_{CC} < 36V; \ -40^{\circ}C < T_{J} < 125^{\circ}C; \ unless otherwise specified$

Table 3. Power section

Symbol	Parameter	Test conditions		Тур	Max	Unit
V _{CC}	Supply voltage		10		36	V
		I _{OUT} = 0.5A; T _J = 25°C			0.2	Ω
R _{ON}	On state resistance	I _{OUT} = 0.5A; T _J = 85°C			0.32	Ω
		I _{OUT} = 0.5A; T _J = 125°C			0.4	Ω
		All channels OFF			1	mA
I _S	Supply current	On state; $V_{IN} = 30V$; $I_{OUT} = 0V$				
		(T _J = 125°C)			6	mA
V _{demag}	Output voltage at turn-off	$I_{OUT} = 0.5A; L_{LOAD} >= 1mH$	V _{CC} -65	V _{CC} -55	V _{CC} -45	V

Table 4. Switching ($V_{CC} = 24V$)

Symbol	Parameter	Test conditions	Min	Тур	Max	Unit
t _{d(ON)}	Turn-on delay time of Output current	I_{OUT} = 0.5A, Resistive Load Input rise time < 0.1 μ s, T_J = 25°C T_J = 125°C		30	40 60	μs μs
t _r	Rise time of Output current	I_{OUT} = 0.5A, Resistive Load Input rise time < 0.1 μ s, T_{J} = 25°C T_{J} = 125°C		50	100 115	μs μs
t _{d(OFF)}	Turn-off delay time of Output current	I_{OUT} = 0.5A, Resistive Load Input rise time < 0.1 μ s, T_J = 25°C T_J = 125°C		20	30 40	μs μs
t _f	Fall time of Output current	I_{OUT} = 0.5A, Resistive Load Input rise time < 0.1 μ s, T_J = 25°C T_J = 125°C		8	15 20	μs μs
(di/dt) _{on}	Turn-on current slope	$I_{OUT} = 0.5A,$ $I_{OUT} = I_{LIM}, T_J = 25^{\circ}C$			0.5 2	A/μs A/μs
(di/dt) _{off}	Turn-off current slope	$I_{OUT} = 0.5A,$ $I_{OUT} = I_{LIM}, T_J = 25^{\circ}C$			2 4	A/μs A/μs

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Electrical characteristics VN330SP-32-E

Table 5. Logical input

Symbol	Parameter	Test conditions	Min	Тур	Max	Unit
V_{IL}	Input low level voltage				2	V
V _{IH}	Input high level voltage (1)		3.5			٧
V _{I(HYST)}	Input hysteresis voltage			0.5		V
I _{IN}	Input current	V _{IN} = 0 to 30V			600	μΑ
I _{LGND}	Output current in ground disconnection	$V_{CC} = V_{INn} = GND = DIAG = 24V;$ $T_J = 25$ °C			25	mA
V	(1)	I _{IN} = 1mA	32	36		V
V _{ICL}	Input clamp voltage (1)	$I_{IN} = -1 \text{mA}$		-0.7		V

The input voltage is internally clamped at 32V minimum, however, it is possible to connect the input pins to an higher voltage via an external resistor that is calculated not to exceed 10mA.

Table 6. Protection and diagnostic

Symbol	Parameter	Test conditions	Min.	Тур.	Max.	Unit
V _{DIAG} ⁽¹⁾	Status voltage output low	I _{DIAG} = 5mA (Fault condition)			1	V
V _{SCL} ⁽¹⁾	Status clamp voltage	I _{DIAG} = 1mA	32	36		V
V SCL	Otatas damp voltage	$I_{DIAG} = -1mA$		-0.7		V
V_{USD}	Undervoltage shut down		5		8	V
V_{OL}	Low state output voltage	$V_{IN} = V_{IL}; R_{LOAD} < 10 m\Omega$			1.5	V
I _{LIM}	DC Short circuit current	$V_{CC} = 24V; R_{LOAD} < 10m\Omega$	1		2.5	Α
I _{OVPK}	Peak Short circuit current	V_{CC} = 24V; V_{IN} = 30; R_{LOAD} < 10m Ω			4	Α
I _{DIAGH}	Leakage on DIAG pin in high state	V _{DIAG} = 24V			100	μΑ
I _{LOAD}	Output leakage current	V_{CC} = 10 to 36V; $V_{IN} = V_{IL}$			50	μΑ
t _{SC}	Delay time of current limiter				100	μS
T _{TSD}	Thermal shutdown temperature		150	170		°C
T _R	Thermal reset temperature		135	155		°C

^{1.} Status determination > $100\mu s$ after the switching edge.

Note: If INPUT pin is floating the corrisponding channel will automatically switch OFF. If GND pin is disconnected, the channel will switch OFF provided V_{CC} not exceed 36V.

VN330SP-32-E Test circuits

4 Test circuits

Figure 4. Avalance energy test circuit

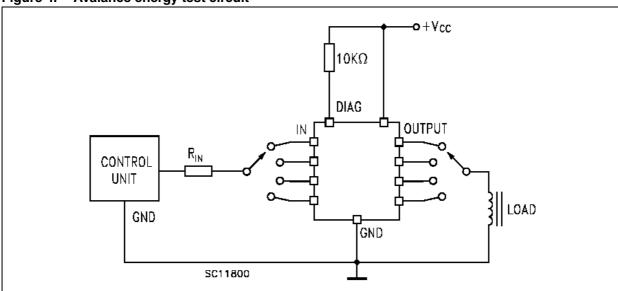
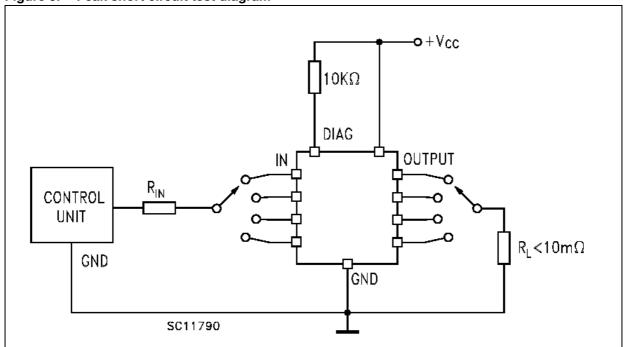


Figure 5. Peak short circuit test diagram



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Switching time waveforms and truth table 5

Table 7. **Truth table**

	INPUTn	OUTPUTn	Diagnostic
Normal operation	L	L	Н
	H	H	Н
Overtemperature	L	L	H
	H	L	L
Undervoltage	L	L	H
	H	L	H
Shorted load	L	L	H
(Current limitation)	H	H	H

Figure 6. Switching waveforms

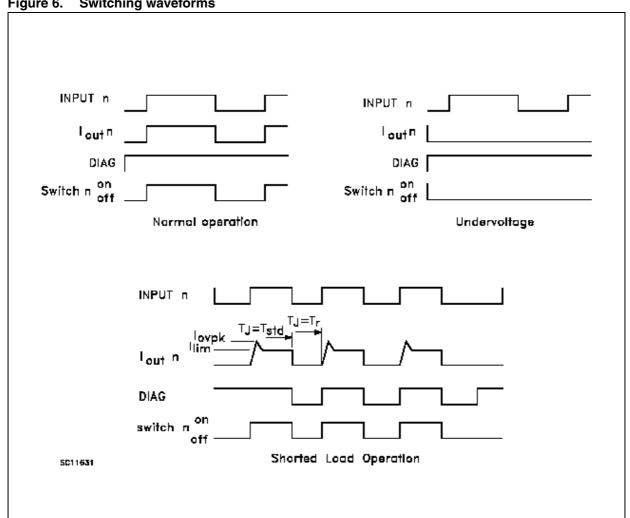


Figure 7. Switching parameter test conditions

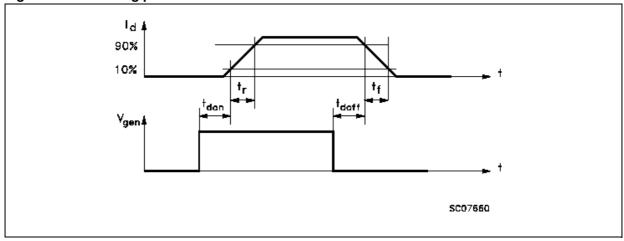
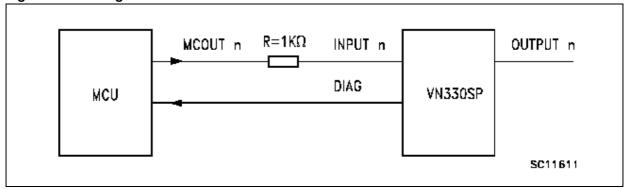


Figure 8. Driving circuit



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Package mechanical data VN330SP-32-E

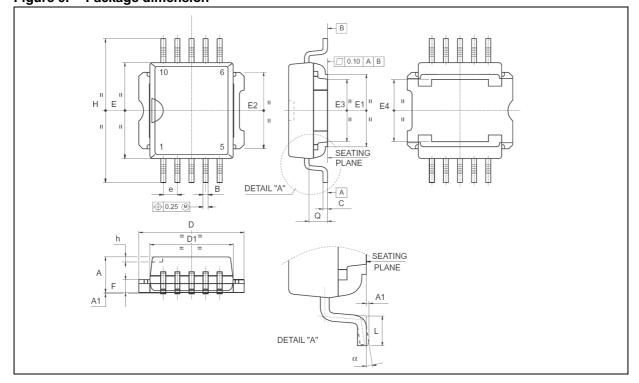
6 Package mechanical data

In order to meet environmental requirements, ST offers these devices in ECOPACK® packages. These packages have a Lead-free second level interconnect . The category of second level interconnect is marked on the package and on the inner box label, in compliance with JEDEC Standard JESD97. The maximum ratings related to soldering conditions are also marked on the inner box label. ECOPACK is an ST trademark. ECOPACK specifications are available at: www.st.com

Table 8. PowerSO-10 Mechanical data

Di		Mm			Inch	
Dim	Min	Тур	Max	Min	Тур	Max
Α	3.35		3.65	0.132		0.144
A1	0.00		0.10	0.000		0.004
В	0.40		0.60	0.016		0.024
С	0.23		0.32	0.009		0.012
D	9.40		9.60	0.370		0.378
D1	7.40		7.60	0.291		0.300
Е	9.30		9.50	0.366		0.374
E1	7.20		7.40	0.283		0.291
E2	7.20		7.60	0.283		0.300
E3	6.10		6.35	0.240		0.250
E4	5.90		6.10	0.232		0.240
е		1.27			0.050	
F	1.25		1.35	0.049		0.053
Н	13.80		14.40	0.543		0.567
h		0.50			0.002	
L	1.20		1.80	0.047		0.071
q		1.70			0.067	
а	0°		8°			

Figure 9. Package dimension

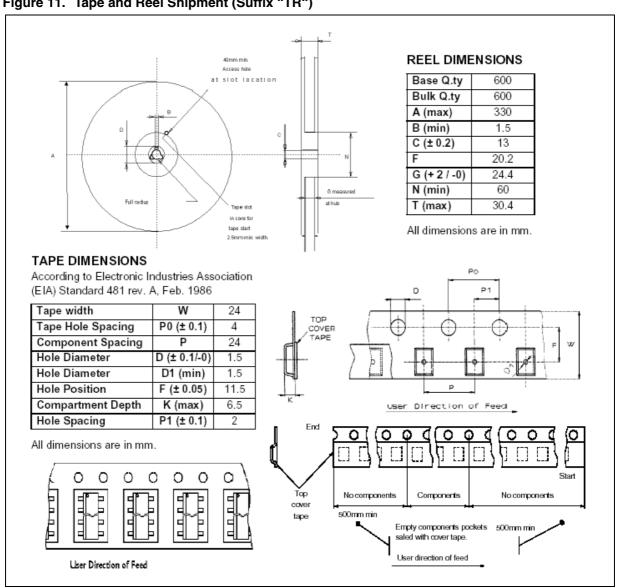


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CASABLANCA MUAR 0.64 - 0.6 All dimensions are in mm. Base Q.ty Bulk Q.ty Tube length (± 0.5) Α В C (± 0.1) Casablanca 50 1000 532 10.4 16.4 8.0 1000 Muar 50 532 4.9 17.2 8.0

Figure 10. PowerSO-10TM Suggested Pad and Tube Shipment (No Suffix)

Figure 11. Tape and Reel Shipment (Suffix "TR")



VN330SP-32-E Order code

7 Order code

Table 9. Order code

Part number	Package	Packaging
VN330SP-E	PowerSO-10 TM Tube	
VN330SPTR-E	PowerSO-10 TM	Tape and reel

Revision history VN330SP-32-E

8 Revision history

Table 10. Revision history

Date	Revision	Changes			
5-Sep-2005	1	Initial release			
19-Mar-2007	2	Document reformatted, typo in Note 1 on page 6			

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